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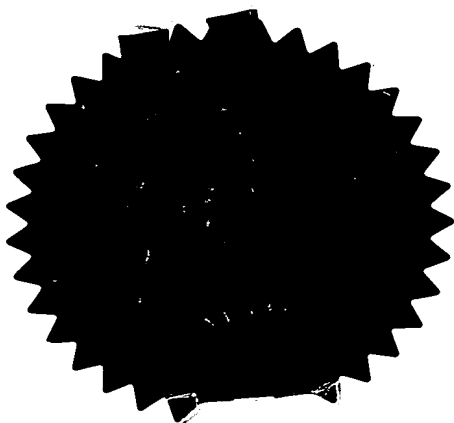


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3. Full name, address and postcode of the or of each applicant (underline all surnames)	Nibble Ltd 31 Belitha Villas LONDON N1 1PE United Kingdom 8148306001		
Patents ADP number (if you know it)	UK		
If the applicant is a corporate body, give the country/state of its incorporation	UK		
4. Title of the invention	Information management system and method		
5. Name of your agent (if you have one)	Kennedys Floor 5, Queen's House 29 St Vincent Place GLASGOW G1 2DT United Kingdom		
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# **INFORMATION MANAGEMENT SYSTEM AND METHOD**

## **Field of the Invention**

This invention relates to a user interface for displaying, organising, and interacting with information sources.

## **Background**

With the growth in volume and complexity of computerised information, user interfaces for organising and displaying that information in such a way as to enable a user to navigate, work with and alter that information have become gradually more important. Perhaps the most commonly used interface at the present time is Windows®. In particular, for complex file management the most commonly used program is Windows® Explorer, which displays a hierarchical customisable list of files on a computer. Although this program functions well, information can only be displayed in a form which represents literally the directory structure in

1 which such data is stored and it is not readily  
2 customisable.

3  
4 A primary aim of the present invention is to provide a more  
5 intuitive, customisable and readily navigable system.

6  
7 US Patents 6,154,213; 6,031,537; and 6,037,944 to  
8 Natrifificial® LLC describe a program known under the trade  
9 name of The Brain™ which displays a graphical representation  
10 of individual items of information and the relationships  
11 between them. One item of information (known therein as 'a  
12 thought') is central and other related thoughts are  
13 displayed around it depending on specified relationships.  
14 Users can navigate through such an inter-connected network  
15 of central information sources by successively selecting a  
16 new central information source. This network can also be  
17 modified by the user. Here relationships between data items  
18 can be arranged and displayed in a particular format.  
19 However, there are limits to this system. For example,  
20 individual data items can only be presented in one place in  
21 the organisation, only one static data source can be  
22 associated with a node and the structure of the organisation  
23 cannot be readily derived from another underlying data  
24 structure such as a hierarchical filing system.

25  
26 Also, in The Brain™, there is no global view: a user only  
27 sees the central thought and icons representing the  
28 immediate parent, sibling and child thoughts. The Brain™  
29 has no consistent large-scale structure but re-arranges all  
30 the thoughts around a chosen central thought, which can be  
31 disorientating.



1  
2 An object of the present invention is to provide a  
3 consistent visual representation of information which a user  
4 can easily navigate.

5  
6 US 5,812,134 to Critical Thought Inc enables information in  
7 a database to be depicted as "molecules" arranged in a  
8 linear progression related to the organisational structure  
9 of the database along a thread.

10  
11 US 5,838,326 to Xerox Corporation presents a way of  
12 displaying an interactive with large numbers of document  
13 objects in a three-dimensional space.

14  
15 US 5,721,900 to International Business Machines Corp  
16 provides a way of visually depicting graphical queries of  
17 the database.

18  
19 The aim of the present invention is to provide an improved  
20 user interface and way of structuring and navigating data.

21  
22 **Brief Description of the Invention**

23  
24 According to a first aspect of the present invention there  
25 is provided computer apparatus for use in accessing and  
26 organising information sources, comprising:

27  
28 means for generating a graphical user interface on a  
29 display screen, the graphical user interface having a  
30 plurality of nodes, a node comprising link means for  
31 linking to an information source;  
32

1 means for arranging said nodes in a three dimensional  
2 graphic representation indicating relationships between  
3 said nodes;

4  
5 said information sources being accessible by selection  
6 of said link means by user interaction with input  
7 means;

8  
9 wherein each node has the capacity to have none, one or  
10 more than one link means.

11  
12 Preferably, a relationship between two or more nodes is  
13 imparted by the relative positioning of the nodes.

14  
15 More preferably, the means for generating a graphical user  
16 interface comprises means for displaying a representation of  
17 a simulated three dimensional space comprising nodes having  
18 three dimensional coordinates associated therewith.

19  
20 A simulated user viewpoint may be maintained within the  
21 simulated three dimensional space and calculates graphical  
22 images as if the user were located at the user viewpoint  
23 within the simulated three dimensional space.

24  
25 The computer apparatus typically further comprises a sound  
26 generation means, the sound generation means producing a  
27 sound depending on the location in the simulated three  
28 dimensional space relative to the user viewpoint of nodes  
29 which link to sound information sources.

30

1 One or more nodes may comprise a link means to an  
2 application and selection of said link activates said  
3 application.

4  
5 Preferably, the computer apparatus comprises user interface  
6 means for enabling a user to create, move and alter nodes or  
7 links to information sources.

8  
9 Preferably also, the computer apparatus comprises user  
10 interface means for specifying the relationship between  
11 nodes.

12  
13 The visual or aural appearance of a node typically depends  
14 on properties of the node or its information sources. Such  
15 properties may include: age, ownership, importance, age of  
16 node, results of a query, frequency of use, size, type,  
17 speed of link to information source, location of information  
18 source.

19  
20 The visual appearance of a node may be altered by  
21 dynamically varying the visual or aural properties or  
22 position of the node.

23  
24 The same node may appear more than once within the simulated  
25 three dimensional space.

26  
27 The computer apparatus may be adapted to highlight multiple  
28 instances of the same node in response to selection of a  
29 node.

30  
31 Preferably, the computer apparatus is adapted to prepare a  
32 plurality of nodes from a hierarchical filing system.

1  
2 The computer apparatus may also be adapted to automatically  
3 link to a node information received, sent or newly created.  
4 Optionally, a new node may be created upon receiving,  
5 sending or creating information. The information may be  
6 received, sent or newly created in the form of a message.  
7 The message may be an e-mail message.

8  
9 An information source may further comprise a link to  
10 information concerning the node.

11  
12 According to a second aspect of the present invention there  
13 is provided a method of controlling a graphical user  
14 interface comprising the steps of:

15  
16 maintaining a database of nodes and relationships  
17 between said nodes, each node comprising a link to  
18 none, one or more than one information source;

19  
20 creating a data structure comprising a model of said  
21 nodes arranged in a simulated three dimensional space  
22 in a manner depending on the relationship between said  
23 nodes; and

24  
25 causing a graphic display program to prepare a visual  
26 display corresponding to said data structure.

27  
28 Preferably, a relationship between two or more nodes is  
29 imparted by the relative positioning of the nodes.

30  
31 More preferably, the graphic display program displaying a  
32 representation of a simulated three dimensional space with

1 reference to three dimensional coordinates associated with  
2 each node.

3

4 A simulated user viewpoint may be maintained within the  
5 simulated three dimensional space and calculating graphical  
6 images as if the user were located at the user viewpoint  
7 within the simulated three dimensional space.

8

9 Sounds may be generated using a sound generation means,  
10 wherein the sound generated depends on the location in the  
11 simulated three dimensional space relative to the user  
12 viewpoint of nodes which link to sound information sources.

13

14 One or more nodes may comprise a link means to an  
15 application and selection of said link activates said  
16 application.

17

18 Preferably, a user can create, move and alter nodes or links  
19 to information sources by use of a user interface.

20

21 User interface means may be used to specify the relationship  
22 between nodes.

23

24 The visual or aural appearance of a node may depend on  
25 properties of the node or information sources. These  
26 properties may include: age, ownership, importance, age of  
27 node, results of a query, frequency of use, size, type,  
28 speed of link to information source, location of information  
29 source.

30

1 The visual appearance of a node may be altered by  
2 dynamically varying the visual or aural properties or  
3 position of the node.

4  
5 Preferably, a node may appear more than once within the  
6 simulated three dimensional space.

7  
8 Multiple instances of the same node might be highlighted in  
9 response to selection of a node.

10  
11 The method may further comprise the step of preparing a  
12 plurality of nodes from a hierarchical filing system.

13  
14 The method may further comprise the step of automatically  
15 linking to a node information received, sent or newly  
16 created. Optionally, a new node may be created upon  
17 receiving, sending or creating information. The information  
18 may be received, sent or newly created in the form of a  
19 message. The message may be an e-mail message.

20  
21 Preferably, an information source further comprises a link  
22 to information concerning the node.

23  
24 According to a third aspect of the present invention there  
25 is provided a computer program comprising program  
26 instructions which, when loaded into a computer, will cause  
27 it to perform as the computer apparatus of the first aspect.

28  
29 According to a fourth aspect of the present invention there  
30 is provided a computer program comprising program  
31 instructions which, when loaded into a computer, will cause  
32 it to carry out the method of the second aspect.

1  
2 According to a fifth aspect of the present invention there  
3 is provided a computer readable media comprising the  
4 computer program of the third aspect.

5  
6 According to a sixth aspect of the present invention there  
7 is provided a computer readable media comprising the  
8 computer program of the fourth aspect.

9  
10 **Description of the Drawings**

11  
12 An example embodiment of the present invention will now be  
13 illustrated with reference to the following Figures in  
14 which:

15  
16 Figure 1 is a figurative drawing of a computer suitable  
17 for implementing the invention;

18  
19 Figure 2 is a schematic representation of a node;

20  
21 Figure 3 is a schematic representation of a galaxy of  
22 nodes;

23  
24 Figure 4 is a perspective representation of a universe  
25 comprising of four galaxies;

26  
27 Figure 5 is a flow chart of a method for preparing a  
28 visual representation of a universe of nodes; and

29  
30 Figure 6 illustrates a data structure for storing  
31 information about a universe of nodes.  
32

## Detailed Description of the Invention

The present invention is a computer-based user interface for displaying a three-dimensional representation of information sources. The invention also relates to methods of navigating through the displayed information, adding information to the database and working with underlying information sources.

In this specification and the appended claims, the term "information source" relates to any electronically stored data such as documents, databases, applications, pointers to other data such as addresses of files or hyperlinks, information streams such as sound or video which may or may not be pre-recorded, and any other source of data. Information streams, such as video, may be provided in an analogue state or read in an analogue format and digitised as and if required.

Figure 1 illustrates a computer in which the software herein disclosed can be executed. The computer **1** comprises at least one microprocessor and storage means, has a display means such a monitor **2** and access to a database **3** of information sources. Although the database **3** of information sources is shown external to the computer **1** in Figure 1, it will most typically be an internal memory storage device such as a hard drive.

Information sources might be derived from more than one database and information might also be included from information streams **4** such as audio or video stream



1 information from a file, a peripheral such as CD ROM or an  
2 external source, for example, the Internet.

3  
4 Input devices such as a keyboard 5 and mouse 6 are also  
5 provided. In the present invention, information sources are  
6 treated as objects and displayed in a three-dimensional  
7 space, within which they can be arranged and interacted  
8 with. Further information sources can be categorised, added  
9 and related to other information sources through  
10 manipulation of the objects within the three-dimensional  
11 space.

12  
13 Figure 2 shows a node which is a unit of categorised  
14 information in the user interface of the present invention.  
15 A node 100, has a title 101 and nil or one information  
16 sources 102 containing notes pertaining to the node or its  
17 contents which can be accessed by clicking on the visible  
18 link. It also contains nil, one or more than one associated  
19 information sources 103 which can be accessed by clicking on  
20 the visible links. Links are usually icons; other  
21 possibilities include text, such as the title of the  
22 information source. Most nodes have information sources  
23 associated with them; here, these are documents labelled  
24 'Peter Camenzind' and 'Siddharta'.

25  
26 Nodes, according to the present invention, are related to  
27 but different from either folders in standard hierarchical  
28 filing system or thoughts in The Brain™ as typified in US  
29 6,037,944 and 6,031,537. Folders in hierarchical filing  
30 systems such as Unix, DOS or Microsoft® Windows® can contain  
31 multiple files and other folders. They can have names and  
32 some limited selection of other properties applied to them.

1 However, they cannot contain information streams and they  
2 are strictly hierarchical, other than where alias or  
3 shortcuts are used to link folders to different places. In  
4 The Brain™ each thought can contain at most a single file.  
5 This can not be an information stream and the thought only  
6 appears once in the network of thoughts at the same time.

7  
8 Figure 3 shows a collection of nodes known herein as a  
9 galaxy of nodes, as displayed on screen. Nodes in a galaxy  
10 are connected directly or indirectly by links or  
11 associations. More than one galaxy can be contained in the  
12 same overall representation, referred to as a universe.  
13 Galaxies are separate if there is no link or association  
14 between them. The galaxy of nodes will be displayed three-  
15 dimensionally and the relative positioning of the nodes  
16 indicates associations between them. For example, in Figure  
17 3, node **100a** 'Authors' is associated with 'Favourite  
18 Authors' **100b** and 'European Authors' **100c**. The relative  
19 positioning of nodes is discussed further below. It will be  
20 seen that there is a three dimensional character to the  
21 network as is shown by the positioning of **100e** behind **100d**  
22 and **100f** from the particular camera angle. For the purpose  
23 of illustration, Figure 4 shows a universe comprising of  
24 four galaxies where all nodes are the same radius and so  
25 their apparent relative size illustrates their distance from  
26 the observer. Preferably, nodes can be any size, and may  
27 differ in size according to the number of information  
28 sources they contain.

29  
30 Associations have an hierarchical sense in which 'child'  
31 nodes are linked to 'parent' nodes which are generally fewer  
32 in number and often relate to more general concepts.

1 However, there are important differences between the parent-  
2 child relationships displayed in the present invention from  
3 the simple hierarchical folder structure of operating  
4 systems such as DOS 6.1, MacOS and Unix.

5  
6 In figure 3, node **100d** appears twice in the arrangement: the  
7 node entitled 'Herman Hesse' is contained both in favourite  
8 Authors and European Authors. Changes to underlying  
9 information sources grouped within each node, thereby affect  
10 both nodes.

11  
12 As well as conventional static files, information sources  
13 may also be streamed information which can be output  
14 continuously through the user interface, for example, a  
15 video clip **104** or sound clips. Information streams can be  
16 live or pre-recorded and they can be played in a window on a  
17 computer screen or over speakers for an audio stream instead  
18 of simply listing them with a static descriptor. For  
19 example, web pages, video/audio or dynamically changing text  
20 such as stock prices , can be readily displayed using  
21 conventional software techniques well-known in the art to  
22 display an information stream in a specified area of a  
23 screen.

#### 24 25 **Preparation of a user interface**

26  
27 Figure 5 illustrates the process by which a universe of  
28 nodes is displayed on a screen or output through other  
29 peripherals such as loudspeakers. Information concerning  
30 the nodes, the relationship between nodes and information  
31 sources associated with such nodes is stored data **10**. This  
32 is processed **20** to produce a spatial arrangement data file

1 **30**, for example, by parsing the list of nodes **10** and  
2 calculating co-ordinates associated with them. Different  
3 graphical representations of the hierarchical structure may  
4 be prepared in response to the value of a parameter **21**. The  
5 underlying logic and connections between the nodes can  
6 therefore be readily represented in different ways by  
7 processing data according to this method. Typically,  
8 relationships between nodes are indicated by the relative  
9 position of nodes to each other.

#### 11 **Example galaxy structure**

13 Figure 3 illustrates an example representation in which a  
14 hierarchy of nodes is implied by presenting a top level  
15 (**100a**), a mid level ( **100b** and **100c**) and a lowest level  
16 (**100d,100e,100f**) on successive spaced planes. Grouping  
17 between nodes is represented by presenting related low level  
18 nodes, e.g. **100d, 100e, 100f** close together and close to  
19 their parent node **100b**. Mid level nodes **100b** and **100c** are  
20 spaced out, on the same plane, to allow the lowest level  
21 nodes to be displayed clearly, but when viewed on a large  
22 scale they are still close to their mutual parent node **100a**.  
23 As many or few successive levels may be provided as is  
24 required and planes need not be flat; for example, they may  
25 be spherical shells.

27 In an alternative representation, the graphical arrangement  
28 of nodes is analogous to a solar system with a central 'sun'  
29 node and child nodes displayed as planets. This can then be  
30 displayed within 'galaxies' within a 'universe' model.

1 In another alternative, each node is displayed in a format  
2 designed to look like atoms in standard representation of a  
3 molecule. Nodes are positioned around a circle (the  
4 diameter of which may be adapted depending on the number of  
5 parent-child relationships relating to that node) and their  
6 positions may be altered to avoid obscuring important  
7 features. When there are too many nodes to fit in a single  
8 circle, a further circle of greater radius is provided.  
9 Each time a node is added to or removed from the  
10 arrangement, the entire structure may be recalculated,  
11 checking no parts overlap using known collision detection  
12 algorithms.

13  
14 The separation of the prepared position data file **30** from  
15 the underlying stored data **10** in response to a parameter **21**  
16 allows the display to be readily adapted without changing  
17 the underlying parent-child relationships.

#### 18 19 **Data structure**

20  
21 Figure 6 shows the prepared data **30**. Individual nodes are  
22 represented by data structures **31**. Each of the titles  
23 associated with it **32a, 32b, 32c** and the co-ordinates **33a,**  
24 **33b, 33c** associated with the node in the particular  
25 graphical representation dictated by parameter **21**. A list  
26 of children nodes **34a, 34b, 34c** is provided. Notice that  
27 similarly parent nodes, being nodes higher up in a pseudo-  
28 hierarchical structure, **35a, 35b, 35c** are also listed.  
29 Notice that **34a** has two children, whereas **34b** and **34c** do  
30 not. Any number of children and parents can be used.

A list of files or information sources **36a**, **36b** and **36c** is provided. There can be no information sources, only one information source **36a**, **36b** or multiple information sources **36c**. Data structure **30** could store all the information of a particular information source. However, more likely, it would be a pointer to the information such as the address, a location in a filing system or other pointer to an information source.

Notes **102** relating to a node rather than to a particular information source can also be provided, for instance in the form of an icon which displays the notes when selected.

#### **Presentation of user interface**

Importantly, the invention does not concern itself with the mechanics of actually graphically displaying the underlying universe of nodes and merely goes as far as calculating a spatial arrangement data file **30** and how these relate to information sources.

Graphical processing software **40** to provide a visually displayed image **50** can therefore be adapted to the particular hardware upon which the machine is running. Typically, when software is implemented on a PC, Microsoft® DirectX® Technology provides a useful interface for displaying graphics adapted to a particular graphics accelerator in a particular PC. This software calculates the effects of perspective and other visual properties and prepares an image from the underlying data. Another technology would be Open GL. Essentially the third party graphic display software **40** which requires only the X, Y, Z

1 co-ordinates and other parameters of objects to be displayed  
2 and can adapt to produce a two-dimensional representation on  
3 screen of the underlying three-dimensional structure. This  
4 modular nature makes it readily adaptable so, for example,  
5 it is possible to introduce a system which outputs the data  
6 in true 3D form for the user to view with 3D glasses such as  
7 shutterglasses, for example, Sony® Glastron® or anaglyph  
8 imaging techniques.

9

10 It is possible to maintain the co-ordinates of a viewpoint  
11 and camera angle of a user within the three-dimensional  
12 universe of nodes. Additionally, a camera angle and scaling  
13 factor can be stored and used by graphical processing  
14 software to produce an image corresponding to a particular  
15 viewpoint by standard image processing techniques.

16

17 This allows additional effects to be created. For example,  
18 a soundscape can be created in which as the co-ordinates of  
19 the user's viewpoint move around different nodes, sounds are  
20 produced which simulate the sounds the user would hear, were  
21 each source of sound taking place at the location in three-  
22 dimensional space of that node and were the user at the  
23 specified viewpoint in three-dimensional space. Sounds from  
24 individual nodes are attenuated according to their distance  
25 from the user's simulated position and/or the screen.

26 Different sounds may attenuate differently to improve  
27 perception of specified sounds. Different audio streams from  
28 information sources associated with nodes can be combined  
29 with their volume being in proportion to the distance  
30 between the viewpoint and the node in three-dimensional  
31 space. Other mathematical relations between sound volume  
32 and distance, such as an inverse square of distance



1 relationship, may be used and the precise mathematical  
2 relation can be adapted to the particular application. A  
3 three-dimensional audio system can be used in conjunction  
4 with this invention so as to further improve the user  
5 interface.

6

#### 7 **User interaction with user interface**

8

9 The viewer can rotate and zoom in and out of the universe of  
10 nodes so as to get a better overview of the totality of  
11 information and the inter-relationships between individual  
12 items. This manipulation aids the user in accessing a  
13 cluster or single item of information. Movement of the user  
14 can be implemented by updating their position co-ordinates,  
15 camera angle and the like by methods well known in the field  
16 of computer aided design and simulators and then refreshing  
17 the screen display.

18

19 Movement of the user through the simulated space can be  
20 implemented by a number of means known in the field of  
21 computer simulation. In one example suitable for use with a  
22 conventional PC keyboard, pressing the left mouse button  
23 whilst holding the shift key zooms in and the right button  
24 zooms out. Equally, moving the mouse whilst holding the  
25 shift key down will move the whole structure in the opposite  
26 direction of the mouse movement. Moving the mouse without  
27 the shift key down holds the structure in place but allows  
28 the mouse to roam over it. Any time the mouse moves over a  
29 node causes all instances of that node in the universe to  
30 flash.

31



1 Individual nodes can be moved, arranged, cut and pasted  
2 within three-dimensional space. Adding/ removing/ moving  
3 nodes and their children can be achieved by right clicking  
4 on a node which brings up a menu from which the various  
5 commands can be triggered. Nodes can be selected by left-  
6 clicking, cut by either CTRL-X or by bringing up a menu by  
7 right clicking on the node and then choosing cut. To paste  
8 as a child of another node either select the new parent and  
9 press CTRL-V or choose from the right button menu. To create  
10 a new galaxy then select 'space' and then do the same.

11

12 All the sub-structure below a chosen node will automatically  
13 be moved/copied/pasted accordingly. In such a case the x,y  
14 coordinates will be where the mouse is and the z coordinate  
15 will be a pre-set distance from the screen.

16

17 Interaction with the graphical user interface allows  
18 interaction with underlying information sources. For  
19 example, one can select a document, edit the document and  
20 therefore change the actual document itself by calling an  
21 executable editing program associated with the document type  
22 as is well known in contemporary operating systems.

23

#### 24 **Use of system as computer desktop interface**

25

26 In one embodiment, the system can be used as the heart of a  
27 three-dimensional equivalent of a standard computer desktop.  
28 In this embodiment, the system becomes the computer's  
29 primary user interface for accessing files and applications.

30

31 Selecting an information source opens the corresponding  
32 information source for viewing or editing. For example,

1 selecting an information source which corresponded to a word  
2 processing document would cause the corresponding word  
3 processor program to open up, editing the word processing  
4 document, analogously to the response of Unix, Windows®,  
5 MacOS® and other operating systems known at the present time  
6 to selection of a document associated with an application.

7  
8 Executable programs can also be represented as information  
9 sources and executed when icons corresponding to them are  
10 selected by the user of the interface.

11  
12 **Creating a universe of nodes from an existing filing system**  
13 **or database.**

14  
15 Although a universe of nodes can be user designed, a  
16 universe of nodes can also be created from an existing file  
17 hierarchy or database. For example, an hierarchical filing  
18 system can be searched electronically and nodes created  
19 equivalent to folders within that hierarchical filing  
20 system. Parent - child relationships are set up between  
21 folders and sub-folders. Files within particular folders  
22 become information sources **103** within the node corresponding  
23 to the particular folder.

24  
25 The system may have predefined, inputted or learned rules on  
26 how to arrange newly created, received or sent information  
27 sources. The way in which they treat data may depend on  
28 whether the information sources are created by third parties  
29 - e.g. stored on a shared storage means - or by the primary  
30 user of the system. The system may establish where to file  
31 a newly created information source by context, for example,  
32 attaching replies to an e-mail to the same or a related

1 node. Suffixes, such as the three letter suffixes use in DOS  
2 and Windows® or file creator info might be used to help  
3 index files. Individual information sources can be scanned  
4 and information found therein can be used to file the  
5 information source.

#### 6 7 **Filing e-mail**

8  
9 For example, when the new e-mail is created, the subject can  
10 be registered with a node and when the e-mail is sent that  
11 e-mail and any attachments or any information sources  
12 relating to it are stored in that node, along with any other  
13 information sources which are already there. Furthermore,  
14 when an incoming e-mail arrives relating to that subject  
15 area it could be stored in the relevant node. The system  
16 can be adapted so that when an e-mail is dragged and dropped  
17 into a node its subject or address or other parameters  
18 selected by the user are automatically registered and any  
19 other e-mails related to that are automatically stored in  
20 that node. Again, the fact that an information source may  
21 be depicted in a plurality of nodes makes it particularly  
22 easy to later establish relevant information. This  
23 automatic filing can readily be applied to other types of  
24 messages such as faxes and SMS text messages or any type of  
25 information sources, received, sent or created, such as  
26 input data streams, newly downloaded files etc.

#### 27 28 **Alternative software configuration**

29  
30 In an alternative software architecture, four distinct types  
31 of software component are provided, together implementing  
32 the system. A first software component functions as graphic

1 processing module **40** and prepares the graphic interface.  
2 For example, using VRML (virtual reality markup language),  
3 Java3D or Macromedia® Shockwave®. These may use DirectX® or  
4 OpenGL® to interface with graphics hardware. A second  
5 software component underneath the first component interfaces  
6 with information sources and calculates the location in  
7 three-dimensional space of the nodes, altering this in  
8 response to user interaction. A third type of plug-in  
9 software component acts as an interface with individual  
10 information source types. For example, a plug-in can be  
11 provided to interface with a conventional operating system  
12 hierarchical filing system enabling the system to be used as  
13 a computer desktop, another might interface with internet or  
14 intranet published information.

15  
16 Finally, a fourth software component enables a user to  
17 publish information sources on their computer or database,  
18 presenting them to remote computers and setting access  
19 rights. The software components may be standalone  
20 applications or may function within a web browser. In one  
21 embodiment, third and fourth software components receive and  
22 share information sources in XML, allowing the documents to  
23 be transmitted using known internet/intranet web sharing  
24 technology.

## 25 26 **Additional features**

27  
28 Other attributes of the node can be made apparent by  
29 changing one of its physical features such as the colour or  
30 size of the node. This can be done to display ownership,  
31 importance, age of a node or other properties. Some  
32 attributes can be properties such as ageing, which may be

1 calculated automatically each time a universe of nodes is  
2 displayed. All manner of attributes may be reflected in the  
3 visual appearance of a node. Some of these attributes  
4 relate to the node and some to properties of one or more  
5 information sources within that node. Example attributes of  
6 nodes or their information sources are: age, size,  
7 ownership, type, frequency of use, speed of link to  
8 information source (e.g. speed of internet connection for  
9 internet provided information stream), relevance to the  
10 results of a search, location etc.

11

12 Nodes can appear in multiple places at the same time. An  
13 information source may also appear in different nodes at the  
14 same time. The invention therefore acts like a relational  
15 database. In practice, there will preferably be only one  
16 copy of the underlying data or the underlying node in  
17 memory, but visually the node can be displayed more than  
18 once according to its relationship with other nodes.

19

20 There are two possible ways in which this can be carried  
21 out. Either two logically separate nodes with identical  
22 information sources associated with them can be stored in  
23 memory or, alternatively, a single node can have more than  
24 one set of co-ordinates and more than one set of  
25 parent/child relationships. The latter case is preferred.

26

27 As an additional feature, selecting an individual node or  
28 information source calls all instances of that particular  
29 object to change a physical attribute, for example by  
30 flashing or moving.

31

1 A user may be given, in response to their selection or  
2 otherwise, a selective view of the universe of nodes  
3 according to any criteria they select, for example, access  
4 rights, document ownership or authorship, type of document  
5 or information source. This could involve rearranging the  
6 universe of nodes but, preferably, nodes fulfilling the  
7 criteria are highlighted in another way - for example, all  
8 other nodes are dimmed to highlight the selected nodes or  
9 replaced with placeholders.

10  
11 In a multi-user version of the invention, whenever new nodes  
12 or information sources are added, other users are alerted to  
13 the fact and a new item can be highlighted by changing a  
14 physical attribute such as the colour of the node. This can  
15 be changed for a period of time and could appear different  
16 to different users. In one embodiment, the underlying data  
17 **10** is shared but each user has a separate spatial  
18 arrangement data file **30** and navigates separately through  
19 the simulated three dimensional space. In another  
20 embodiment the same coordinate information from the spatial  
21 arrangement data file **30** is the basis for the display  
22 presented to each user; however, this data file is  
23 customised, e.g. by altering the visual properties of nodes,  
24 to provide a customised view to each user, reflecting their  
25 own preferences and attributes particular to that user, such  
26 as access rights.

27  
28 The user can alter the distance between nodes and filter out  
29 particular nodes eg by darkening them or cutting them out so  
30 as to increase visibility. This may be carried out  
31 automatically by calculating whether some nodes are likely

1 to be blocking the view. For example, nodes very close to  
2 the viewpoint of the user might be omitted.

3  
4 An additional module may be provided to store the co-  
5 ordinates of the nodes and re-load them when required,  
6 reducing the need to fully recalculate the spatial  
7 arrangement data file **30** each time the system is booted up.

8  
9 An additional software module can manipulate the molecule  
10 and the most frequently used nodes can be made more  
11 accessible through the position of jump buttons on screen  
12 which, when selected, cause the user to move to a viewpoint  
13 close to that particular frequently used node.

14 Alternatively, the graphical or audio attributes of the most  
15 frequently used nodes can be altered. For example, they may  
16 be easily displayed as glowing as if to represent friction  
17 from having been used in a manner allied to that disclosed  
18 in US 5,684,969. The most frequently used nodes can be  
19 calculated either by tracking the number of times a node is  
20 selected by the user, or by calculating the amount of time  
21 that the node spends being close to the viewpoint of the  
22 user.

23  
24 Nodes may be automatically animated. For example, they can  
25 rotate about one more of their axis. The distance between  
26 them can increase and decrease periodically. As well as  
27 purely visual effects, this will enable the user to more  
28 readily browse the overall structure without having nodes  
29 fixed in locations where they obscure others permanently.  
30 This can be achieved by altering the information **30** fed to  
31 the graphics engine **40**.

1 Some nodes can be represented as translucent. In a typical  
2 graphical representation, the user is considered as having a  
3 viewpoint which is a location within the same three-  
4 dimensional simulated space in which the nodes are modelled.  
5 It is a standard procedure to calculate a visual rendering  
6 of the scene from the co-ordinates of the objects to be  
7 displayed and the co-ordinates and camera angle of the user.  
8 It is also well known for the user by interacting with  
9 peripherals 5, 6, to manoeuvre the viewpoint and camera  
10 angle through a simulated three-dimensional space.

11

12 Alterations to the displayed properties of nodes (e.g.  
13 colour, glowing, opacity, movement) can be implemented  
14 either by a software module altering the spatial arrangement  
15 data file 30 between successive display updates or by  
16 passing parameters to the graphic engine 40. For example,  
17 many known graphic rendering tools allow opacity to be set  
18 as a parameter.

19

20 Although the embodiments described herein and with reference  
21 to the drawings comprise computer programs and processes  
22 performed in computer apparatus, the invention also extends  
23 to computer programs, particular programs on or in a  
24 carrier, adapted for putting the invention into practice.  
25 The program may be the form of source code, object code, a  
26 code intermediate source and object code in a partially  
27 compiled form, or in any other form suitable for the  
28 implementation of the processes and apparatus according to  
29 the invention. The carrier may be any entity or device  
30 capable of carrying the program.

31



1 For example, the carrier may comprise a storage medium, such  
2 as a ROM, for example a CD-ROM or semiconductor ROM, or a  
3 magnetic recording medium, for example a floppy disk or hard  
4 disk. Further, the carrier may be a transmissible carrier  
5 such as an electrical or optical signal which may be  
6 conveyed via electrical or optical cable or by radio or  
7 other means. When the program is embodied in a signal which  
8 may be conveyed directly by a cable or other device or  
9 means, the carrier may be constituted by such cable or other  
10 device or means. Alternatively, the carrier may be an  
11 integrated circuit in which the program is embedded, the  
12 integrated circuit being adapted for performing, or for use  
13 in the performance of, the relevant processes.

14

15 Further alterations and modifications can be made within the  
16 scope of the invention herein disclosed.

**CLAIMS**

1. Computer apparatus for use in accessing and organising information sources, comprising:

means for generating a graphical user interface on a display screen, the graphical user interface having a plurality of nodes, a node comprising link means for linking to an information source;

means for arranging said nodes in a three dimensional graphic representation indicating relationships between said nodes;

said information sources being accessible by selection of said link means by user interaction with input means;

wherein each node has the capacity to have none, one or more than one link means.

2. The computer apparatus of Claim 1 wherein a relationship between two or more nodes is imparted by the relative positioning of the nodes.

3. The computer apparatus of Claim 1 wherein the means for generating a graphical user interface comprises means for displaying a representation of a simulated three dimensional space comprising nodes having three dimensional co-ordinates associated therewith.

- 1    4.    The computer apparatus of Claim 3 which maintains a  
2        simulated user viewpoint within the simulated three  
3        dimensional space and calculates graphical images as if  
4        the user were located at the user viewpoint within the  
5        simulated three dimensional space.  
6
- 7    5.    The computer apparatus of Claim 3 further comprising a  
8        sound generation means, the sound generation means  
9        producing a sound depending on the location in the  
10       simulated three dimensional space relative to the user  
11       viewpoint of nodes which link to sound information  
12       sources.  
13
- 14   6.    The computer apparatus of Claim 1 wherein one or more  
15       nodes comprise a link means to an application and  
16       selection of said link activates said application.  
17
- 18   7.    The computer apparatus of Claim 1 comprising user  
19       interface means for enabling a user to create, move and  
20       alter nodes or links to information sources.  
21
- 22   8.    The computer apparatus of Claim 1 comprising user  
23       interface means for specifying the relationship between  
24       nodes.  
25
- 26   9.    The computer apparatus of Claim 1 wherein the visual or  
27       aural appearance of a node depends on properties of the  
28       node or its information sources.  
29
- 30   10.   The computer apparatus of Claim 9 wherein the  
31       properties of the node or its information sources  
32       include one or more of: age, ownership, importance, age

1 of node, results of a query, frequency of use, size,  
2 type, speed of link to information source, location of  
3 information source.  
4

5 11. The computer apparatus of Claim 1 wherein the visual  
6 appearance of a node is altered by dynamically varying  
7 the visual or aural properties or position of the node.  
8

9 12. The computer apparatus of Claim 1 wherein the same node  
10 appears more than once within the simulated three  
11 dimensional space.  
12

13 13. The computer apparatus of Claim 1 adapted to highlight  
14 multiple instances of the same node in response to  
15 selection of a node.  
16

17 14. The computer apparatus of Claim 1 adapted to prepare a  
18 plurality of nodes from a hierarchical filing system.  
19

20 15. The computer apparatus of Claim 1 adapted to  
21 automatically link to a node information received, sent  
22 or newly created.  
23

24 16. The computer apparatus of Claim 15 wherein a new node  
25 is created upon receiving, sending or creating  
26 information.  
27

28 17. The computer apparatus of claim 15 wherein information  
29 is received, sent or newly created in the form of a  
30 message.  
31

1 18. The computer apparatus of Claim 17 wherein a message is  
2 an e-mail message.

3  
4 19. The computer apparatus of Claim 1 wherein an  
5 information source further comprises a link to  
6 information concerning the node.

7  
8 20. The computer apparatus of Claim 1 wherein the graphical  
9 user interface functions as a computer desktop.

10  
11 21. A method of controlling a graphical user interface  
12 comprising the steps of:

13  
14 maintaining a database of nodes and relationships  
15 between said nodes, each node comprising a link to  
16 none, one or more than one information source;

17  
18 creating a data structure comprising a model of said  
19 nodes arranged in a simulated three dimensional space  
20 in a manner depending on the relationship between said  
21 nodes; and

22  
23 causing a graphic display program to prepare a visual  
24 display corresponding to said data structure.

25  
26 22. The method of Claim 21 wherein a relationship between  
27 two or more nodes is imparted by the relative  
28 positioning of the nodes.

29  
30 23. The method of Claim 21 wherein the graphic display  
31 program displaying a representation of a simulated

1       three dimensional space with reference to three  
2       dimensional co-ordinates associated with each node.

3  
4   24.   The method of Claim 23 comprising maintaining a  
5       simulated user viewpoint within the simulated three  
6       dimensional space and calculating graphical images as  
7       if the user were located at the user viewpoint within  
8       the simulated three dimensional space.

9  
10   25.   The method of Claim 23 further comprising the step of  
11       generating sound using a sound generation means,  
12       wherein the sound generated depends on the location in  
13       the simulated three dimensional space relative to the  
14       user viewpoint of nodes which link to sound information  
15       sources.

16  
17   26.   The method of Claim 21 wherein one or more nodes  
18       comprise a link means to an application and selection  
19       of said link activates said application.

20  
21   27.   The method of Claim 21 wherein a user can create, move  
22       and alter nodes or links to information sources by use  
23       of a user interface.

24  
25   28.   The method of Claim 21 wherein user interface means may  
26       be used to specify the relationship between nodes.

27  
28   29.   The method of Claim 21 wherein the visual or aural  
29       appearance of a node depends on properties of the node  
30       or information sources.

31

- 1 30. The method of Claim 29 wherein the properties include  
2 one or more of age, ownership, importance, age of node,  
3 results of a query, frequency of use, size, type, speed  
4 of link to information source, location of information  
5 source.  
6
- 7 31. The method of Claim 21 wherein the visual appearance of  
8 a node is altered by dynamically varying the visual or  
9 aural properties or position of the node.  
10
- 11 32. The method of Claim 21 wherein the same node appears  
12 more than once within the simulated three dimensional  
13 space.  
14
- 15 33. The method of Claim 21 further comprising the step of  
16 highlighting multiple instances of the same node in  
17 response to selection of a node.  
18
- 19 34. The method of Claim 21 comprising the step of preparing  
20 a plurality of nodes from a hierarchical filing system.  
21
- 22 35. The method of Claim 21 further comprising the step of  
23 automatically linking to a node information received,  
24 sent or newly created.  
25
- 26 36. The method of Claim 35 wherein a new node is created  
27 upon receiving, sending or creating information.  
28
- 29 37. The method of claim 35 wherein information is received,  
30 sent or newly created in the form of a message.  
31
- 32 38. The method of Claim 37 wherein a message is an e-mail.

- 1  
2 39. The method of Claim 21 wherein an information source  
3 further comprises a link to information concerning the  
4 node.  
5
- 6 40. The method of Claim 21 wherein the graphical user  
7 interface functions as a computer desktop.  
8
- 9 41. A computer program comprising program instructions  
10 which, when loaded into a computer, will cause it to  
11 perform as the computer apparatus of Claim 1.  
12
- 13 42. A computer program comprising program instructions  
14 which, when loaded into a computer, will cause it to  
15 carry out the method of Claim 21.  
16
- 17 43. A computer readable media comprising the computer  
18 program of Claim 41.  
19
- 20 44. A computer readable media comprising the computer  
21 program of Claim 42.

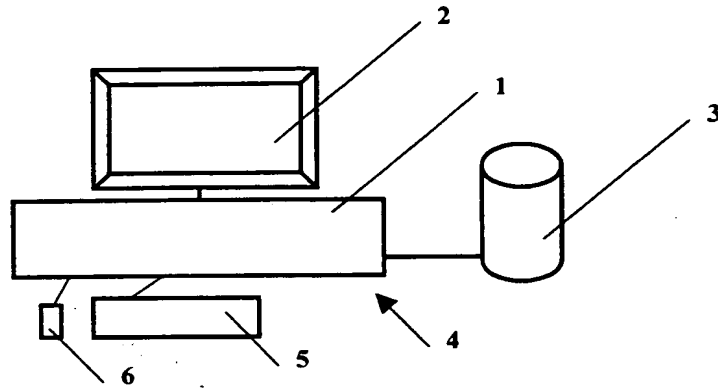


1 **ABSTRACT**

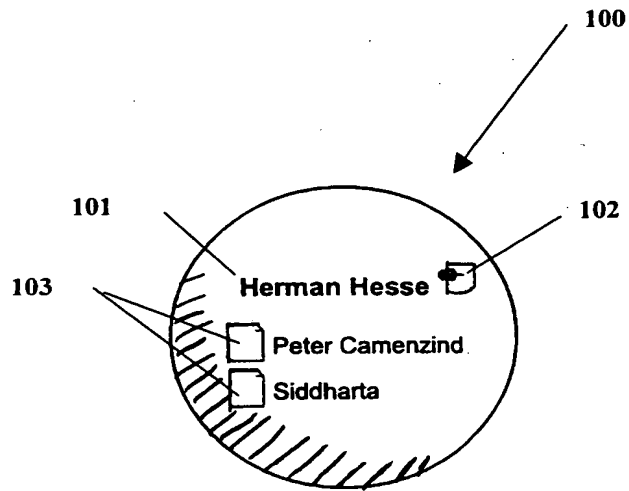
2

3 Method and apparatus for implementing a computer user  
4 interface comprising of a representation of a plurality of  
5 nodes within a simulated three dimensional space. Nodes may  
6 contain links to information sources which can be static  
7 files or information streams. User can manipulate nodes and  
8 information sources and can navigate within the simulated  
9 three dimensional space. In one embodiment, the user  
10 interface can be applied as an alternative to conventional  
11 computer desktops.

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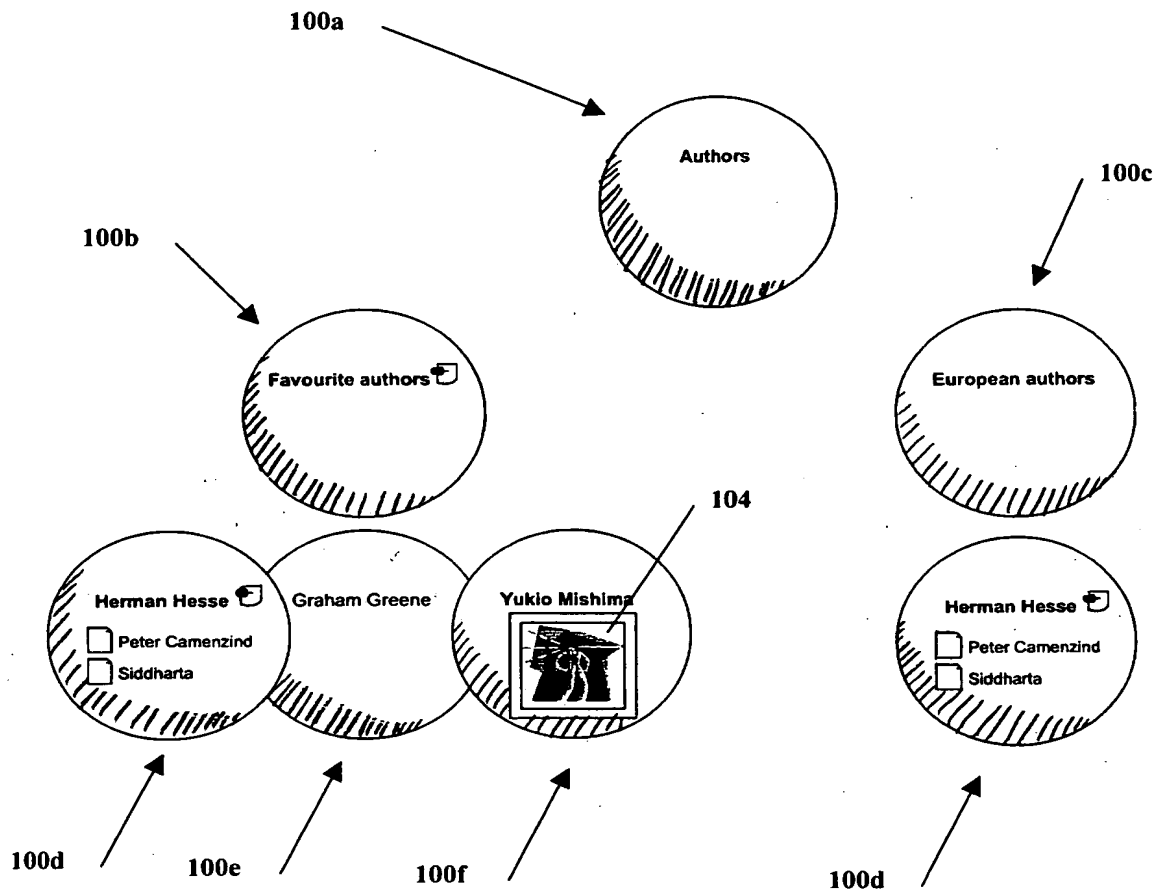


**Figure 1**



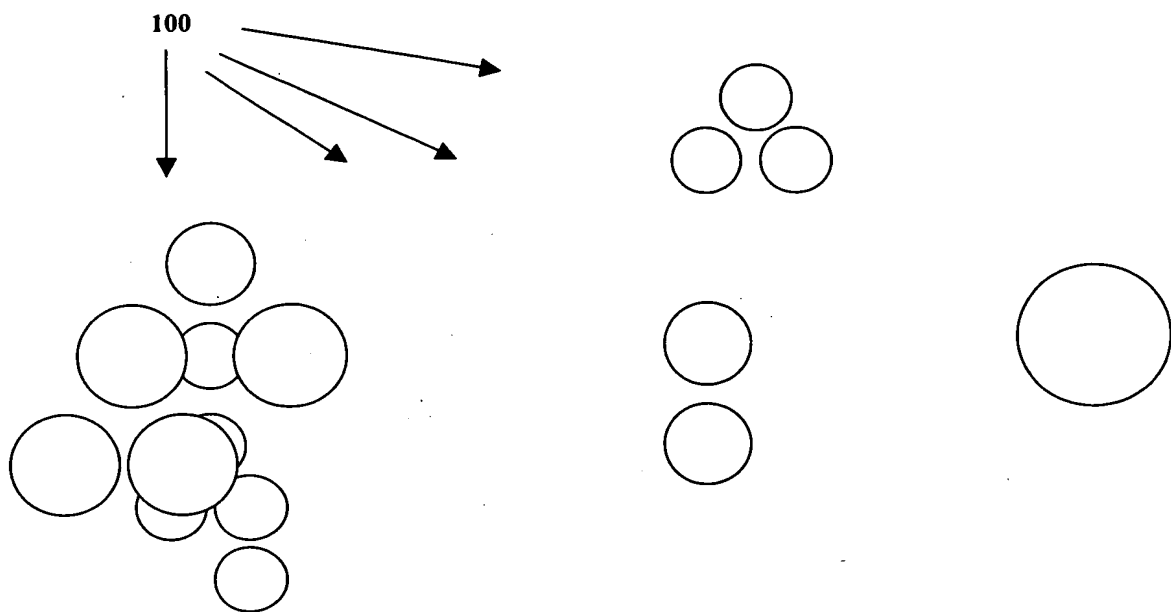
**Figure 2**

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**Figure 3**

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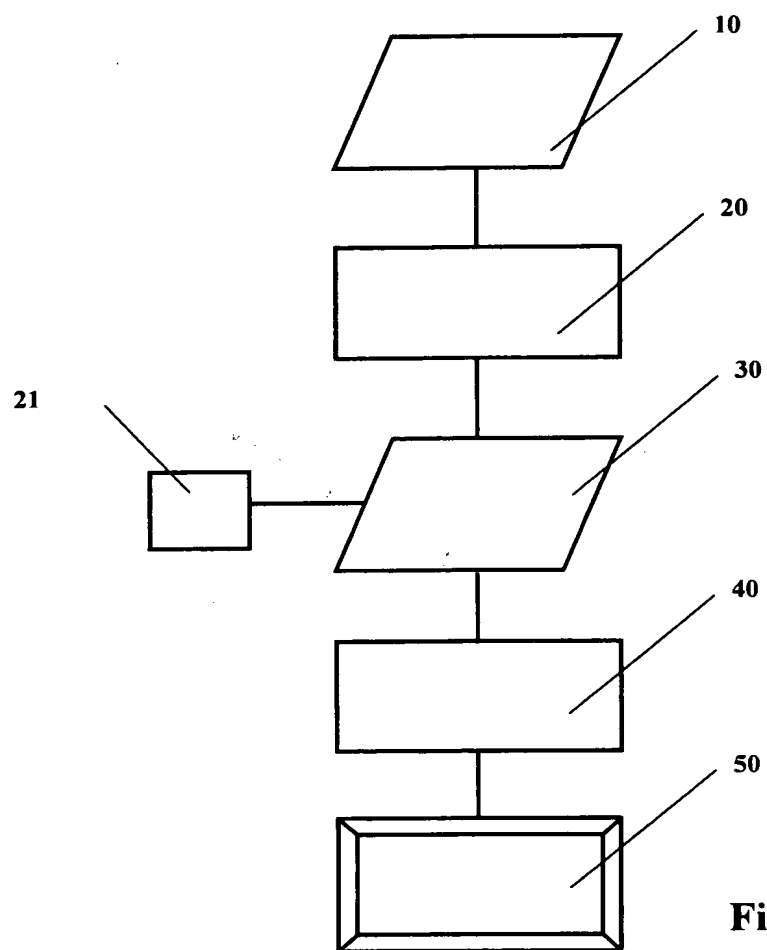


**Figure 4**

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4 / 5



**Figure 5**

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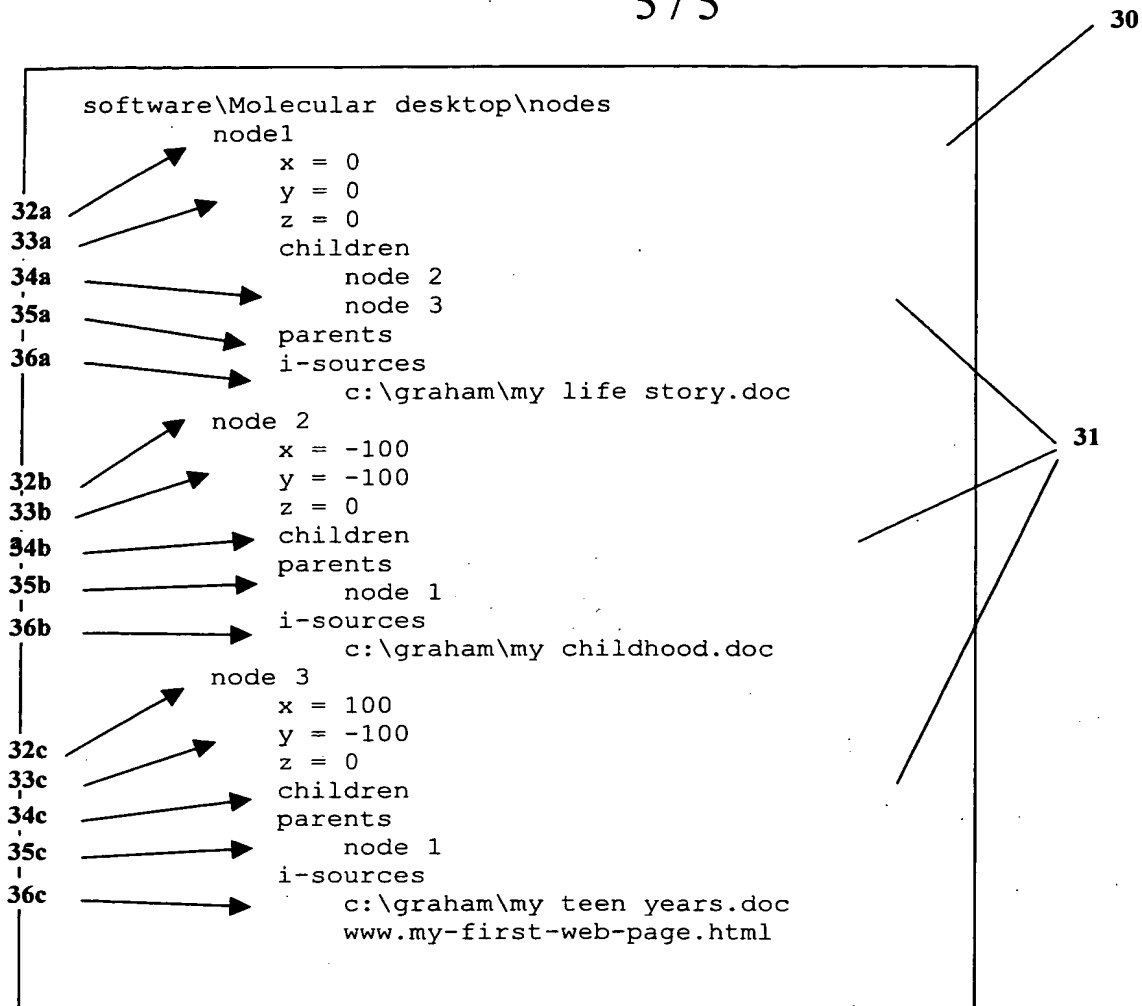


Figure 6

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